

a nervous system of its own which is of merely provisional importance and which already begins to develop in the latter part of the embryonic period. At the anterior pole, which is distinguished by the tuft of cilia, a delicate system of fibres was observed by Bury, who conjectures that it is possibly nervous. The apparatus proves to be of a highly complicated character. The cells of this region, which we may term the apical pit, consist of sense-cells and undifferentiated supporting-cells. Both kinds of elements are rod-shaped, and their nuclei lie at somewhat variable altitudes near the inner ends. These latter appear to be blunt in the case of the supporting-cells, but in the sense-cells, on the contrary, are drawn out into a fine process which penetrates into the layer of the nerve-fibres. The nerve-fibre layer is of considerable thickness at the apex, but diminishes very rapidly towards the periphery; it is only on the ventral surface that a powerfully developed cord of fibres extends on each side of the vestibular invagination far into the posterior section of the body. Under the apical pit the layer of fibres is bounded towards the primary body-cavity and the mesenchyma cells by a basement membrane, which appears at a very early stage in the embryonic development. Even before the cells of the apical pit had attained their definite histological character, as supporting and sense-cells, numerous ectoderm cells separated from their connexion with the epithelium and wandered into the depths, to become transformed into ganglion cells, which lie above and between the layer of fibres. Isolated ganglion cells are also embedded in the two ventral longitudinal nerve-trunks.

Soon after the attachment of the larva the entire nervous system disappears, and it is not until much later, some two to three weeks after the attachment takes place, that there appears at the oral disk—which proceeds from the vestibular invagination—an extremely delicate nerve-ring, which is identical with the apparatus described by Ludwig as the sole nerve-centre of the adult form. It is of exclusively ectodermal origin, and beside the fibres scattered ganglion cells can be distinguished. I have not been able to follow up the origin of the second and third nervous systems of the adult, which were discovered by Carpenter and Jickeli, since in the oldest of the larvæ examined by me the rudiments of them were not yet visible.—*Zoologischer Anzeiger*, xv. Jahrg., no. 404 (Oct. 31, 1892), pp. 391-393.

*On Deglutition in the Synascidiæ.* By S. JOURDAIN.

The mechanism of deglutition in the Composite Ascidiæ, by which I mean the Ascidiæ Sociales of H. Milne-Edwards, is still imperfectly understood.

Several naturalists, applying to these animals what Hermann Fol found to be the case in *Doliolum*, have supposed that the nutritive particles follow the groove of the endostyle. This groove secretes a cylinder of mucus which agglutinates these particles and which, in consequence of the action of the vibratile cilia with which the groove is lined, descends towards and enters the stomach.

M. Giard, relying on experiments tried at Roscoff, by means of carmine administered to living Synaseidians, has contended that deglutition takes place by the *dorsal* side, that is to say by the side opposite to the endostyle. This naturalist believes that the apparatus by the aid of which the act is performed is the series of dorsal languettes or the organs which represent them.

In *Clavellina* in particular these languettes, which are merely prolongations of the transverse bands of the left wall of the branchial sac, form a portion of a helicoidal surface upon which the food-particles glide until they gradually reach the stomach.

M. Giard sought to determine the point at which the secretion of the mucus takes place which envelops the nutritive particles. This substance cannot be formed along the spiral apparatus or the dorsal canal, for this region is devoid of glands. M. Giard therefore wonders whether the mucous matter does not proceed from the endostyle; nevertheless he does not explain how, according to this hypothesis, the mucus passes from the ventral surface to the opposite side.

On my part I have experimented upon living specimens of *Clavellina* and *Perophora*. In order to observe the mode of deglutition in these Ascidians it is sufficient, without having recourse to carmine, to place the living animal in sea-water containing a very small quantity of mud in suspension.

By this means we find, as stated by M. Giard, that deglutition takes place by the *dorsal surface*; only we discover at the same time that the alimentary cylinder neither coineides with the median line nor with the series of helicoidal languettes.

The very distinct track formed by the food-particles starts from the dorsal cup and proceeds in a somewhat oblique direction from top to bottom (I place the mouth at the top), at a slight distance from and to the right of the dorsal raphe.

By focusing the microscope accordingly, we observe in an individual lying on its left side first the body-wall and the branchial sac, then the nutritive cylinder, and beneath this the helicoidal languettes situated beyond the raphe.

This, then, is the way in which deglutition is effected:—

On a level with the peri-oesophageal nerve-ring there exists a band of vibratile cilia which conduct the nutritive particles towards an organ in the shape of a pit, which is ciliated and situated on the dorsal side in the neighbourhood of the cerebral ganglion. This pit secretes a large quantity of mucus, by which the food-particles are agglutinated together to form a cord, which descends towards the orifice of the stomach, following the course indicated above. The alimentary cylinder increases a little in diameter as it descends, and finally enters the stomach, the yawning aperture of which lies at the bottom of the respiratory sac.

One of the functions of the vibratile pit therefore seems to me to be established: it secretes the mucus by the aid of which the food-particles are agglutinated into a cord, which is conducted by a ciliated branchial band into the stomach.—*Bulletin de la Société Philomathique de Paris*, 8<sup>ième</sup> série, t. iv. no. 1, 1892, pp. 35, 36.